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# PATENT SPECIFICATION

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## (54) LOCK-OUT MECHANISMS FOR SWITCHES

(71) We, REYROLLE PARSONS LIMITED, a Company registered under the Laws of England, of Hebburn, County Durham, do hereby declare the invention, for which we 5 pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to automatic lock-out mechanism for electric switches having butt contacts, and is particularly although not exclusively applicable to high-voltage hermetically-sealed switches containing fixed and moving current-carrying contacts 15 which are operable to make or break a high-voltage electrical circuit.

The switch may contain an electro-negative gas which may be at a pressure above atmospheric, or the switch may be 20 evacuated to a vacuum of the order of  $10^{-6}$  torr.

An object of the invention is to provide an automatic lock-out device which functions in response to a predetermined degree 25 of contact erosion caused by repeated opening and closing of the switch in service. The invention obviates the need for periodical inspection to determine the degree of contact wear.

30 According to the present invention a switch having butt contacts is provided with automatic lock-out mechanism arranged to be operated by the release of a spring-loaded latch, the latch being held 35 against release by engagement with a detent which is coupled to a movable butt contact of the switch for movement therewith during switch closure to a position dependent on the degree of contact wear, the 40 latch being released by the travel of the detent to a predetermined position on closing of the switch after a predetermined amount of switch contact wear has occurred. For example the detent may comprise a 45 rod movable longitudinally with the

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movable contact on closing of the switch to a position dependent on the degree of contact wear, the latch bearing against the side of the detent rod, and being arranged to pass over the tip of the rod so as to be 50 released thereby when the predetermined amount of contact wear has occurred.

Alternatively, the detent may comprise a pivoted cam lever connected to the movable contact for pivotal movement on 55 closing of the switch, the lever having a cam surface again which a follower member of the latch bears. The position of the latch with its follower in engagement with the cam surface provides an indication of 60 the amount of contact wear that has taken place at any time, and when this reaches the maximum permissible value the pivoted lever is turned to a release position on closing of the switch, in which position 65 the latch follower rides over one end of the cam surface and is released to operate the lock-out mechanism.

The invention may be carried into practice in various ways, but two specific embodiments will now be described with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic view of a 75 latch mechanism associated with the moving contact rod of a hermetically sealed switch, and

Figure 2 is a similar diagram of a modified embodiment.

In the first embodiment, Figure 1 shows 80 diagrammatically a vacuum switch 10 having fixed and movable butt contacts 12, 11 whereof the movable contact 11 is mounted on a plunger rod 11A and is provided with an elongated longitudinally-moving insulated rod 13 whose inner end is attached to the moving contact 11 of the switch 10, the rods 13 and 11A being sealed by a bellows-type seal shown diagrammatically at 14. An adjustable ex- 90

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tension piece 16 is attached to the rod 13 and projects through a clearance bore in a boss 17 on the exterior of the switch end cap 15 to act as a detent. An L-shaped lever 18 is pivoted at 19 to a fixed pivot point, and a toe portion 20 on one arm 21 of the lever 18 projects transversely to the length of the lever arm 21 and is biased against the longitudinally-projecting end of the extension piece 16 by a tensioned spring 22 extending between the switch cap 15 and the other arm 23 of the lever 18. A link 24 is also pivotally attached at one end at 25 to the other arm 23 of the lever 18, and the other end of the link 24 is attached to the switch operating mechanism, not shown, and operates the closing latch lock-out to prevent the resetting of the switch trip latch after the switch has been opened.

Operation is as follows. When the switch is closed by the switch operating mechanism through a linkage not shown, the moving contact 11 moves a distance *a* shown in Figure 1, into abutment with the fixed contact 12, and the rod 13 and the extension piece 16 move a corresponding distance *a* after which the extension piece 16 projects from the guide boss 17 by an amount *b*. The distance *b* is initially set to a dimension equal to the maximum permissible contact erosion of the switch contacts 11 and 12. When this maximum permissible contact erosion has occurred, the end of extension piece 16 will cease to project from the guide boss 17 when the circuit-breaker is in the closed position. As soon as this occurs, the extension piece 16 ceases to restrain the toe 20, and the lever 18 and link 24 will be moved by the spring 22, thereby operating the closing latch lock-out mechanism to lock the switch out in the open condition and prevent reclosing.

The device can be used for remote indication of contact wear by a suitable electro-mechanical circuit coupled to the extension piece 16.

By the addition of a second and similar system of a lever link and spring, all set so as to be released by the extension piece 16 before the lever 18 and link 24 have been released to produce lock-out, a visual warning can be given that the permissible erosion point is being approached.

In the alternative embodiment shown in Figure 2 the extension piece 16 is directly coupled to a detent lever 30 pivoted at 31 on the end cap 15 and having a cam face 32.

The spring 22 biases the lever 18 to press the toe 20 against the cam face 32 on the lever 30. As contact erosion occurs progressively in service, the position of the lever 30 in the switch-closed condition will

progressively rotate in the anti-clockwise direction in Figure 2, so that the corresponding progressive rotation of the position of the lever 18, also in the anti-clockwise direction, is permitted by the cam face 32, 70 with corresponding progressive longitudinal movement of the position of the link 24, also in switch-closed condition, and the progress of the link 24 may operate a potentiometer coupled to the link and connected in an electric circuit, in order to vary the voltage supplied to a simple indicating meter. This meter will then indicate, remotely or locally, the actual degree of contact erosion as it occurs. The 80 tripping and lock-out can be initiated electrically or mechanically in response to the movement of the link 24 when the lever 18 is eventually released by the cam face 32.

The mechanism of Figure 2 operates in the same manner as that described in relation to Figure 1 in that the extension piece 16 is adjusted so that when the switch is closed, the amount of the cam face 32 still to be traversed by the toe 20 90 represents the maximum permitted amount of contact erosion. The electrical circuit is arranged so that the meter reading is initially zero.

As the contacts erode, the switch-closed position of the lever 30 will turn and the cam face 32 will follow by the toe 20, allowing turning of the lever 18 to vary the reading on the meter.

When the lever 30 reaches a position 100 such that the toe 20 passes under the lower end (as seen in the Figure) of the cam face 32, the operating lever 18 is free to rotate fully under the action of the spring 22, thereby moving the link 24 fully to operate 105 the lock-out latches etc.

A device made in accordance with either of these illustrated embodiments of the invention will obviate the need for periodical contact inspection to determine contact 110 wear.

Although the specific embodiments are described in relation to hermetically sealed interrupters, the invention may be applicable to any switch or circuit-breaker 115 having butt contacts which are subject to erosion.

#### WHAT WE CLAIM IS:—

1. An electric switch having butt contacts and having an automatic lock-out mechanism arranged to be operated by the release of a spring-loaded latch the latch being held against release by engagement with a detent which is coupled to a 120 movable butt contact of the switch for movement therewith during switch closure to a position dependent on the degree of contact wear, the latch being released by the travel of the detent to a predetermined 125
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position on closing of the switch after a predetermined amount of switch contact wear has taken place.

2. A switch as claimed in Claim 1 in which the detent comprises a rod movable longitudinally with the movable contact on closing of the switch to a position dependent on the degree of contact wear, the latch bearing against the side of the detent 10 rod, and being arranged to pass over the tip of the rod so as to be released thereby when the predetermined amount of contact wear has occurred.

3. A switch as claimed in Claim 1 in 15 which the detent comprises a pivoted cam lever connected to the movable contact for pivotal movement on closing of the switch, the lever having a cam surface against which a follower member of the latch 20 bears.

4. A switch as claimed in any one of the preceding Claims in which the latch comprises a pivoted lever one arm of 25 which is coupled to the lock-out mechanism of the switch and the other arm of which has a terminal portion which engages against and cooperates with the detent, the lever being spring-biassed in the direction to operate the lock-out mechanism when its terminal portion is released 30 by the detent.

5. A switch as claimed in any one of the preceding Claims in which the coupling of the detent to the movable switch contact 35 is adjustable to enable the degree of contact erosion at which release of the latch occurs to be adjusted.

6. A switch as claimed in any one of the preceding Claims, including means 40 coupled to the detent for providing a remote indication of its position in the closed condition of the switch as an indication of the degree of contact wear.

7. A switch as claimed in Claim 4

when dependent on Claim 3, including an electrical indicating circuit coupled to the latch lever to provide a remote indication of the angular portion of the latch lever dictated by the engagement of its follower with the cam surface of the detent, in the closed condition of the switch, as an indication of the degree of contact wear present.

8. A switch as claimed in any one of the preceding Claims, provided with a second spring-loaded latch also cooperating with the detent and arranged to be released thereby on the occurrence of a lesser degree of contact wear than the first assembly, the second latch not being coupled 60 to the lock-out mechanism but being arranged to provide a warning indication of the imminence of the degree of contact wear required to release the first latch and operate the lock-out mechanism.

9. A switch as claimed in any one of the preceding Claims which is a hermetically-sealed switch having a fixed and a movable butt contact enclosed in a sealed vessel, and in which the detent comprises or is directly coupled to a longitudinally-movable insulated rod secured at its inner end to the movable contact and extending through a sealed aperture in one end wall of the switch vessel.

10. A switch provided with means for operating automatic lock-out mechanism on the occurrence of a predetermined degree of contact wear, as specifically described herein with reference to Figure 1, 80 or to Figure 2, of the accompanying drawings.

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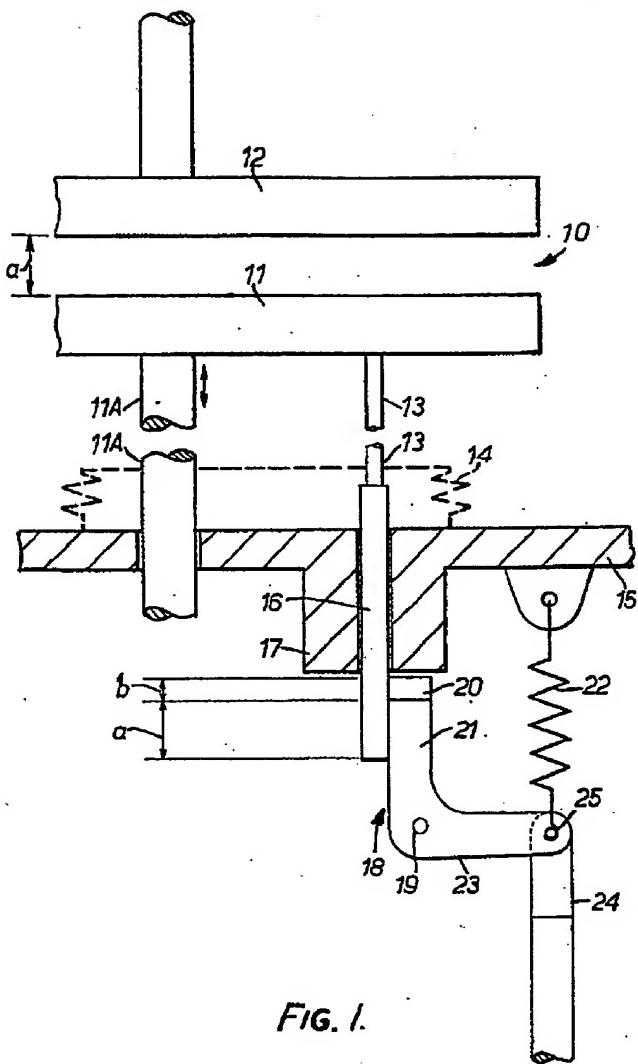


FIG. 1.

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the Original on a reduced scale  
Sheet 2

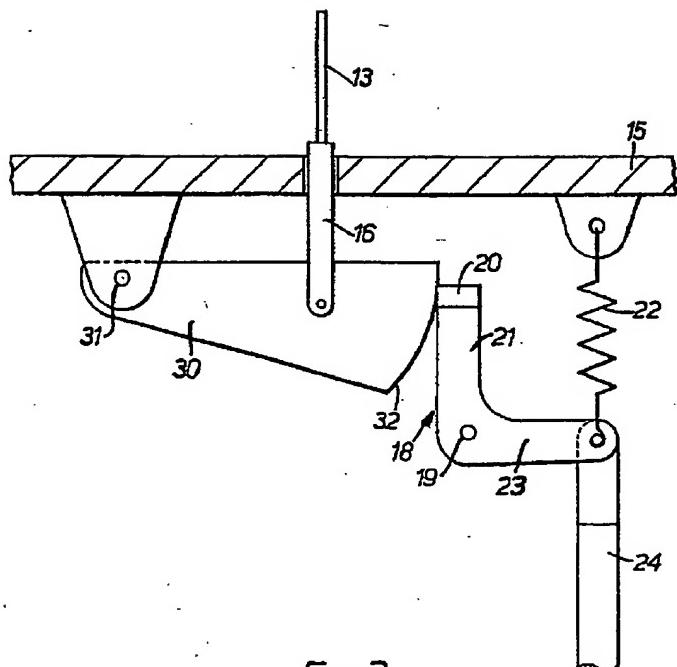


FIG. 2.